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Program Area Presentation

Energy Sciences Network (ESnet)

Advanced Scientific Computing Research
Strategic Planning workshop

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Contribution of Program Element to Overall ASCR Strategic Goal

- ESnet is a high-speed data communications network which allows Department of Energy (DOE) scientists and collaborators worldwide to use unique DOE research facilities and computing resources independent of time and location with state-of-the-art performance levels.

Building an Integrated Network Environment for Distributed Science

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Planning horizon for Program Element

- Short term 1-3 yrs
  - Backbone and site upgrades to allow the DOE high impact science programs to achieve their goals
  - Accommodate 100% growth in traffic each year
- Long term 1-5 yrs
  - Implementation of new network technologies and topologies for projected future applications requirements
- Keep data flowing — provide DOE scientists with the network capabilities they need to support their science

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Areas that the Element currently invests in and Research areas that rely on the ESnet infrastructure support

- **Connectivity**
  - Distributed Network performance measurement and analysis
  - High performance transport protocols
  - Multicast and secure group communication
  - High speed, ubiquitous,and reliable backbone infrastructure
  - Quality of Service (QoS) services
  - New protocol implementation – IPv6
- **Collaborative technologies**
  - Access Grid Technology
  - Data conferencing
  - Ad- hoc H323 (IP based) conferencing
  - Multi platform Video conferencing services
- **Security**
  - Public Key Infrastructure
  - System scanning and intrusion detection tools

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How does Program Element transfer knowledge or provide services to application scientists?

- Energy Sciences Steering Committee (ESSC)
- Energy Sciences Site Coordinating Committee (ESCC)
- Incorporates emerging services as they mature into ESnet
- Internet Engineering Task Force (IETF) partnerships
- Outreach
  - Interagency Large Scale Network (LSN) membership
  - Multi agency/Vendor Joint Engineering Task (JET)Force membership
  - Workshops, conferences, and publications

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Program Element Strengths

- Provides end-to end connectivity that is not available over the commodity Internet
- Community involvement, organization and support (ESSC, ESCC)
  - Operated and managed by user community (scientists)
  - Strong collaboration with the network research and middleware programs
- Single national and international identity for DOE research networking
  - Many long term working relationships with national and international peers
- Long track record and extensive experience in meeting the ever expanding programmatic requirements within budget
- Significant leveraging of overall effort and cost savings with central support staff on 24x7 basis
- Responsive to the special demands of DOE research community
  - QoS, jumbo frames, scavenger service
  - CCC/MPLS for NNSA

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Program Area Weaknesses

- Cultural inertia
  - Programmatic networking needs requirements projections
  - Success metrics for production networks conflicts with success metrics for R&D networks
  - "Networking will be there" mentality
- Technology barriers
  - Perceived low cost of providing high bandwidth services
  - Need it yesterday – not enough time for technology to catch up
  - Unrealistic performance expectations from current technology
  - Less than mature router/switch code
- Organizational barriers
  - Ineffective integration of program responsibilities and accountabilities moving from research to production
  - Long time frame for moving of new technologies into production network

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Program Element Opportunities

- Abundant optical capacity exists in core networks to develop cost-effective agile network infrastructures to support high-impact science applications
- Develop terabit networks and services for interconnecting data analysis and management centers associated with Petascale computers
- Growth in “grids” will create requirements for new central services
- Apply research network technology improvements to accelerate the development of advanced networking services
- Develop additional distributed security services to protect the network and provide user security without cumbersome user services

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Program Element Threats

- Programmatic needs will outstrip network projected growth rate and budget
- "Adequate Networking will always be there" assumption by program elements
- Long-term planning for facilities and programs
- Security policies may neutralize needed performance advances
- Potential reduced longevity of at-risk telecomm vendors due to current market conditions
- Highly specialized network technologies beyond scope of industry

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Program Element Gap Analysis

- End-to-end performance
  - Multi-domain and site network performance improvements
  - Development of reliable Ultra high-speed transport protocols
  - Distributed Network measurement and prediction
- Cyber security
  - scalable distributed authentication and authorization systems
  - Minimal impact on the user and network
- Integrated testbeds and production networks
  - Network research to accelerate advanced technologies
  - Experimental deployment of high-impact applications
  - Ability to use the production network to scale network research testbeds with minimal impact on production